

## ***Spaceward Bound at Ubehebe Crater***

by Stephanie Kyriazis, Education Specialist, Death Valley National Park

The wind at Ubehebe Crater is rarely slack. But today it blew with a ferocity and chill bitterness that evoked the extremes of another planet - which seemed appropriate, since I was here for Spaceward Bound, a professional development opportunity for pre- and in-service teachers that focuses on understanding Earth analogues for landscapes and conditions on the Moon and Mars.

As Education Specialist at Death Valley National Park, I regularly bring groups of 5<sup>th</sup> to 12<sup>th</sup> graders to Ubehebe Crater for an inquiry-based environmental education activity that explores the origin of this giant hole in the ground. The activity is part of the Death Valley ROCKS (Recreational Outdoor Campaign for Kids through Study) program, a three-day, two-night camp experience for under-served students from Las Vegas, Los Angeles, and the park's rural gateway communities. The students make scientific observations and weigh evidence, trying to decide whether Ubehebe materialized through meteor impact, volcanic eruption, phreatomagmatic eruption, nuclear explosion, or sinkhole collapse. We examine rock types on the rim, then hike into the belly of the crater to get a closer look at the interior walls and floor. Once the students have deduced that they are standing at the bottom of a maar, they are tasked with kinesthetically reproducing Ubehebe's violent birth, performing their skit for the rest of the class.

After the final group's "eruption", we discuss how craters are not an Earth-bound phenomenon, but exist throughout our solar system. I describe the work performed by NASA / SETI scientists like Dr. Rosalba Bonaccorsi, to quantify the environmental and sedimentological conditions at Ubehebe, as an analogue for the warmer, wetter conditions that prevailed on Mars in its first billion years. Before we trudge back up the scoria path to the crater rim, the students are asked to consider how their experience in Ubehebe today could represent their first step toward a career exploring similar phenomena throughout the solar system. More than 400 young people participated in this lesson as part of the ROCKS program this school year.

The Spaceward Bound team asked me to share our Ubehebe activity with the teachers. We all huddled on the rim, semi-sheltered from the gale by a short retaining wall, as I provided an overview of the lesson. The wind was as intense as it can be at Martian mid-latitudes, if a bit warmer, so I was impressed that about half of the participants were game to experience the activity full-out, by hiking down to the crater bottom with me. The deeper you hike, the gentler the wind becomes. Teachers collaborated in small groups to create their own creative reenactments of the Ubehebe eruption, with energetic performances that rivaled those of many of my 5<sup>th</sup> graders.

The field trip was an educational experience for me as well. With the Spaceward Bound participants, I made my first sojourn to Little Hebe, learning about the volcanic field's morphology, chronology, and lingering mysteries from the scientists, and sharing pedagogical conversations with the teachers. Before I became a ranger, I trained academically as a geologist. One of Death Valley's great delights is its vastness (with 3.4 million lonely acres under federal management), and geologic complexity, a veritable play-ground for rock lovers. The opportunity to learn a little more about a fascinating corner of that landscape - Ubehebe Crater - and ponder its connection to a distant planet, inspires me with a renewed dedication to my job. With the help of programs like Spaceward Bound, teachers and rangers are empowered to help the public comprehend the physical processes that shape Earth and other celestial bodies.